WHAT IS CLAIMED IS:

1 A zone arc fault detection system for detecting arcing faults in a defined zone of an electrical circuit, such as an aircraft circuit, comprising:

a pair of substantially identical parallel insulated conductors for each zone in which arcing is to be detected, thereby defining a detection zone comprising the length of said parallel conductors between end points where the two conductors are coupled together;

a current sensor operatively associated with each said pair of parallel conductors, said current sensor and said conductors being respectively configured and arranged such that the current sensor produces a signal representative of a difference in current between the two conductors.

2. The system of claim 1 wherein said current sensor comprises a current transformer having a high permeability core.

3. The system of claim 1 wherein said current sensor comprises a Hall effect sensor.

4 The system of claim 1 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.

5. The system of claim 4 wherein said current sensor comprises an air core toroid.

6. The system of claim 5 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 configuration.

7. The system of claim 4 wherein the current sensor produces a signal proportional to the difference between the time derivatives of the current in each conductor and further including a circuit for integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

8. The system of claim 1 wherein said current sensor comprises a resistive shunt constructed so as to produce a voltage difference proportional to the difference in current between said conductors.

9. The system of claim 1 wherein said current sensor comprises a magnetic core, said conductors being operatively coupled with conductors wound around a magnetic core such that magnetic fields of said conductors oppose each other.

10. The system of claim 9 and further including an armature attracted by said magnetic core in response to a current difference in said conductors.

11. The system of claim 1 wherein said current sensor comprises a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.

12. The system of claim 11 wherein said differential current sensor comprises a bi-metal element.

13. The system of claim 1 and further including a fault detector circuit operatively coupled with said current sensor.

14. The system of claim 13 and further including a circuit breaker responsive to said fault detector circuit.

15. The system of claim 1 and further including a circuit breaker responsive to said differential current.

16. The system of claim 1 and further including a relay operatively coupled with said circuit breaker, said relay being responsive to said differential current for operating said circuit breaker.

17. A method for detecting arcing faults in a defined zone of an electrical circuit, such as an aircraft circuit, comprising:

splitting a conductor in each said defined zone into a pair of substantially identical parallel insulated conductors, thereby defining a detection zone comprising the length of said parallel conductors between end points where the two conductors are coupled together;

providing a current sensor operatively associated with each said pair of parallel conductors; and

configuring and arranging a current sensor and said conductors such that the current sensor produces a signal representative of a difference in current between the two conductors.

18. The method of claim 17 wherein said current sensor comprises a current transformer having a high permeability core.

19. The method of claim 17 wherein said current sensor comprises a Hall effect sensor.

20. The method of claim 17 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.

21. The method of claim 20 wherein said current sensor comprises an air core toroid.

22. The method of claim 21 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 configuration.

23. The method of claim 20, including producing a signal proportional to the difference between the time derivatives between the current in each conductor and further including integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

24. The method of claim 17 wherein configuring and arranging said current sensor comprises constructing a resistive shunt so as to produce a voltage difference proportional to the difference in current between said conductors.

25. The method of claim 17 wherein configuring and arranging said current sensor comprises coupling said conductors with conductors wound in opposite directions around a magnetic core.

26. The method of claim 25 wherein configuring and arranging said current further includes providing an armature attracted by said magnetic core in response to a current difference in said conductors.

27. The method of claim 17 wherein configuring and arranging said current sensor comprises providing a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.

28. The method of claim 27 wherein said differential current sensor comprises a bi-metal element.

29. The method of claim 17 and further including coupling a fault detector circuit with said current sensor.

30 The method of claim 29 and further including providing a circuit breaker coupled for response to said fault detector circuit.

31 The method of claim 17 and further including providing a circuit breaker coupled for response to said differential current.

32. The method of claim 17 and further including operatively coupling a relay with said circuit breaker for responding to said differential current for operating said circuit breaker.